PHYSIOLOGY AT THE BRITISH ASSOCIATION.

THE section of physiology concerned itself very largely with the consideration of questions which are of practical importance to workers in South Africa at the present time. Such diseases as scurvy, leprosy, and plague offer problems which demand instant consideration, and in some cases legislation. The treatment of these maladies formed the subject-matter of papers by the medical officer for Cape Colony and his staff.

The diseases of cattle are at present of great importance in South Africa; they played a prominent part in the proceedings, both at Cape Town and at Johannesburg. The fate of the four colonies, but especially of Rhodesia, is intimately bound up with their value for rearing horses, cattle, sheep, and goats. In recent years, and more especially since the importation of stock from all parts of the world during and after the Transvaal war, several forms of disease have attacked the domestic animals of South Africa. The severity of these diseases may be judged from the fact that 97 per cent. of the horses at Umtali died of horse-sickness in a recent epidemic. No more pressing problems, therefore, than the cause and prevention of stock diseases present themselves to the students of pathology in South Africa. At Cape Town the morning of August 17 was devoted to their consideration. Two important communications were given by Mr. Hutcheon, principal veterinary surgeon for Cape Colony, and Mr. Lounsbury, Government entomologist in Cape Colony. Mr. Hutcheon's great experience of the subject, extending as it does from a time when the parasitic nature of these diseases was unknown, and his constant and successful efforts to combat successive devastations, render his communication especially valuable. In recent years Mr. Lounsbury also has done a vast amount of first-class work in connection with the habits and life-history of the various forms of tick which act as intermediate hosts for the piroplasmic organisms. At Johannesburg a very comprehensive paper on rinderpest was given by the Hon. George Turner, and one of much interest on horse-sickness and similar maladies by Dr. Theiler, principal veterinary surgeon of the Transvaal. Colonel Bruce's presidential address dealt also with stock diseases.

The importance of South Africa as a health resort occupied the entire sitting of August 16. Sir Lauder Brunton opened a discussion upon the effect of climate upon disease and upon health. Dr. Gregory and other South African medical officials took part in this discussion. Results also of great scientific interest upon the effect of high altitudes on health were given by Prof. Bohr, of Copenhagen. Mr. Barcroft described the outcome of recent researches upon the production of heat in the individual organs of the body, and indicated the bearing of these investigations upon the heat-formation of the body under varying climatic and dietetic conditions.

The morning of September 1 was devoted to purely physiological topics.

Some of the more important communications may be summarised as follows:—

August 16.—Discussion on the effect of climate upon health. Sir T. Lauder Brunton, F.R.S., pointed out that three primary points had to be thought of in considering climate, its effect (1) on the human body; (2) on the organisms which give rise to disease; (3) on the carriers of disease. After a detailed investigation of the effects of change of environment upon protoplasm, he showed that for every cell there was an optimum degree of humidity and of salinity; but more important than these was the optimum temperature. When the temperature of the body fell below 98°·4, the vitality, not only of muscle, but of every other tissue, became reduced. The amount of heat produced depended upon the activity of the tissues; the loss of heat largely depended upon the environment (especially the temperature and the humidity). The nature of the soil greatly affected the humidity, but often pathological conditions were put down to the climate which were attributable in reality to the effect of the geological structure of a locality upon its water supply; for instance, the constipation experienced by many persons at sea-side resorts in the south of England was not due, as often supposed, to the sea air, but to the calcareous water. Electrical conditions were referred to, especially the observations of Wier Mitchell and Dexter in America.

Dr. Gregory pointed to the prevalence of tuberculosis in South Africa, of which 17 per thousand of the natives and 7 per thousand of the white population died annually. On the other hand, scarlatina, small-pox, typhoid, and influenza existed in much milder forms than in Europe.

Prof. Bohr, speaking of the effect of high altitudes upon health, introduced the results of his most recent investigations upon the invasion and evasion coefficients of oxygen in contact with liquid surfaces, and used these coefficients to calculate the minimum barometric pressure which was consistent with adequate respiration. He showed how compensation was carried out at low pressures, which, however, were higher than the absolute possible minimum. The full account of his investigations appears in Nagel's "Text-book of Physiology"—article on respiration—to which the reader is referred.

Mr. Barcroft dealt with the heat production in the organs of secretion and excretion, and showed that these organs were responsible for a much greater share of the heat produced in the body than was formerly supposed. The following figures might be taken as representing our present knowledge of the heat formation per gram per minute of certain organs when at rest:—The submaxillary gland, 0·2 calories; the kidney, 0·15 calories; skeletal muscle, 0·02 calories. In climates, therefore, where the opportunity for heat loss was small (*e.g.* hot-damp climates) these organs should not be unduly taxed.

Other speakers were Dr. A. J. Mitchell, Prof. Sims Woodhead, Dr. Murray, and Prof. Halliburton, F.R.S.

August 17.—Mr. Hutcheon, principal veterinary surgeon, gave an historical account of the diseases which had devastated the stock of South Africa—pleuropneumonia, redwater, rinderpest, east coast fever, biliary fever, horse-sickness, &c. Of these, heartwater, rinderpest, and horse-sickness were the results of ultramicroscopic blood-parasites, whilst the redwater of cattle and the east coast fever were definite piroplasmic diseases. Ticks were responsible for the communication of heartwater, redwater, and east coast fever; horse-sickness was probably communicated by a mosquito. Mr. Hutcheon went fully into the means that were now taken for preventing these diseases. In the cases of redwater, heartwater, and rinderpest inoculation had been successfully carried out.

Mr. Hutcheon attributed the absence of horses in South Africa to the fact that zebras took horse-sickness, but not fatally, and thus the infection was kept alive.

Mr. Chas. P. Lounsbury, Government entomologist for Cape Colony, treated of ticks as a means of transmission of disease. The main features in the economy of ticks were first discussed. *Amblyomma hebraeum* is the tick responsible for conducting the heartwater of goats, sheep, and cattle. It therefore prevents the successful farming of wooled sheep and Angora goats over a considerable tract of the country. The tick becomes infected at one stage of its life-cycle and communicates the disease at another. The requisite condition of warmth is necessary during the metamorphosis of the tick if the disease is to be communicated. Sheep of the Persian breed take the disease more mildly than other varieties, and the virus is somewhat modified by passing through them. The progeny of the transmitting tick appears to be innocuous. *Haemophysalis leachi* is responsible for the communication of canine piroplasmosis. Unlike *Amblyomma hebraeum,* this tick only communicates the virus by means of adults which are the progeny of infected females. The virus, therefore, passes through the egg, and remains latent in the nymphal and larval stages.

African east coast fever is communicated, like heartwater, by the nymphs or adults of ticks which have themselves fed upon a sick animal. Five species of the genus Eurhipicephalus, viz. appendiculatus, nitens, evertsi, simus, and capensis, have been proved to carry this disease.

Other speakers in this discussion were Colonel Bruce, F.R.S., Sir W. Hely-Hutchinson, Mr. Robertson, Prof. Sims Woodhead, and Mr. Bowhill.

August 18.—Dr. Gregory gave a comprehensive paper recounting the deductions which he had been able to make touching the nature of scurvy as it exists in South Africa.

His main thesis was that the scurvy of South Africa is infectious in its nature, and probably of bacterial origin. It is subject to seasonal variation; it occurs in epidemics which vary in the intensity of their virulence. Its incidence is greatest amongst the native races, and it has a very high percentage of recurrences. An anti-scorbutic diet does not prevent it. It occurs where the diet contains a plentiful supply of fish and vegetables, and does not necessarily occur where these foodstuffs are deficient.

Dr. Mitchell gave a detailed history of the plague epidemics in Cape Colony. He showed that the plague in every case was introduced by rodents, and suggested more stringent measures to prevent the introduction of infected animals.

Dr. R. S. Black, formerly physician to the leper asylum at Robben Island, gave an account of leprosy in South Africa. He dwelt on the accumulation of evidence which existed in favour of leprosy being an infectious disease, and the absence of any data which had come under his notice in favour of this disease being due to the eating of fish. In the discussion which followed the paper Prof. Sims Woodhead pointed out the importance to patients themselves, and to the State, of removing any ambiguity as to the infectious nature of leprosy. It could not be too clearly understood by the native population that the policy of segregation was not prompted by one of a number of rival theories, but was the result of established facts.

On August 19 some of those who had attended the section enjoyed the hospitality of the Cape Government at Robben Island, where they were shown the admirable arrangements for treating the lepers.

Johannesburg, August 29.—The proceedings of the section opened with the president's address. This has been printed *in extenso* in the columns of NATURE; it is therefore unnecessary to refer to it here further than to say that it struck the key-note of the whole work of the day's sitting. Colonel Bruce dealt very fully with the stock diseases of South Africa from the purely scientific side. Those whose papers followed (the Hon. George Turner and Dr. Theiler) dealt with rinderpest and other stock diseases from the point of view of the practical student of the problems which these diseases offered to the farmers and to the executive of the Transvaal. The urgency of the situation which was caused by the rinderpest epidemics and the success of the means which were used to cope with them are shown, as Mr. Turner pointed out, by the fact that 986,518 animals are estimated to have been saved by inoculation. Roughly, four thousand five hundred litres of serum have been used for the inoculation at a cost of 7*l.* 10*s.* per litre. In some herds the method of "simultaneous injection" of virulent blood and immunising serum has been so successful that only 14 per cent. of the cattle have fallen victims to the epidemic, whilst 1·3 per cent. have been killed by the injection.

Dr. Theiler's paper dealt with stock diseases generally; the fact, however, that his name is so intimately connected with recent advances of knowledge into the etiology and prevention of horse-sickness accentuated the interest of that part of his communication which dealt with this disease. Briefly summarised, horse-sickness especially occurs in low-lying districts during the rainy season. Animals are infected only at night. The infection ceases as soon as the frost comes. The disease is inoculable in animals of the same species, but is not contagious. Horse-sickness is distinct from "blaau tongue" or catarrhal fever, which closely resembles it in most of the above characteristics. The virus of horse-sickness is easily destroyed by desiccation, but it is not affected by cold. Both the above diseases are conveyed from animal to animal by insects. Veterinary Surgeon Spreuill has succeeded, by hyper-immunising sheep with virulent blood, in producing a serum which is efficacious in cases of "blaau tongue." The author has achieved immunity against horse-sickness in mules and horses by simultaneous subcutaneous injection of serum and intravenous injection of virus.

August 30.—An interesting feature of the work of the section, and one for which it is much indebted to the officials, was a visit to the compound hospital, presided over by Drs. Louis G. Irvine and Donald Macaulay. As an introduction to the inspection, a paper was communicated by Dr. Macaulay and Dr. Irvine upon the conditions of native labour in the mines. They pointed out the great difficulty of persuading the native workers to care for their own health, to take even the simplest precautions, for instance, on coming up from the deep mining levels into the cold air. The death-rate was much lower than formerly, but it was still very high as the result of pneumonia and phthisis. The main problem, however, is that of acclimatisation.

Other papers were read by Dr. Leingme on diseases of natives, Dr. Maberley on the pharmacology of South African drugs, and Prof. McKendrick, F.R.S., on the effect of radium on the electric currents of the retina.

September 1.—Prof. Waller, F.R.S., gave an account of his recent researches into the means of estimating the percentage of chloroform vapour in air by means of the densimeter. He showed how frequently the cause of death was due, not to idiosyncrasy of the patient, but to an unsuspected increase in the dose of chloroform. This might occur whatever method was used, but it was specially likely to happen when the so-called "Edinburgh method" of administration with a towel was used. His experiments had shown in theory what had already been proved by practice, namely, that a mask covered with donette delivered the proper percentage of chloroform to the patient, namely, 2 per cent.

Dr. Pavy, F.R.S., read a paper for which the thanks of the section are due to him in an unusually large measure. The main thesis was based upon Dr. Pavy's well known view that the comparatively small molecules into which the food is broken down in the intestine do not exist in the blood as such. This view is the result of so much practical experience of the treatment of diabetes and of so much careful thought and accurate work that it must always command the respect of physiologists if not their adherence. The part of Dr. Pavy's paper dealing with the mechanism which exists for building up such molecules as sugar into the larger molecules of which they form but a small part was of a much more speculative nature. The author's view was that this function was performed by the lymphocytes, which took up sugar, &c., much as hæmoglobin acquires oxygen. The sugar is thus built up into the molecules of living protoplasm, and is subsequently imparted to the plasma and indirectly to the body.

Dr. M. Armand Ruffer gave a brief account of the evolution of the present knowledge of immunity artificially acquired. His own researches show that the serum of rabbits injected with human, bovine, or ovine urine dissolves *in vitro* the red blood corpuscles of that species of animals the urine of which has been injected. It is specific, *i.e.* has no action on the red blood corpuscles of any other species of animals. The author calls lysogen the substance which, when injected, produces a hæmolytic serum. Lysogen dialyses slowly, is not precipitated completely by alcohol, but wholly by saturation with ammonium sulphate or lead acetate. Simple exposure to air for one month or more destroys it, though it resists putrefaction and is not wholly destroyed by a temperature of 100° C. Urine contains hæmosozin or hæmosozins, *i.e.* a substance or substances preventing the action of hæmolytic serum. Some urines, *e.g.* human urine, prevent the action of serum dissolving human, bovine, and ovine red blood corpuscles; others, *e.g.* bovine urine, act only on a serum dissolving bovine red blood corpuscles. Dialysed urine is just as active as ordinary urine. Hæmosozin has practically the same physical and chemical characteristics as lysogen. Bile contains at least two groups of hæmolysins, and at least one hæmosozin. This hæmosozin is specific, *i.e.* prevents the hæmolytic action of the bile of that species of animals from which the hæmosozin was extracted, but not the biliary hæmolysins of any other species of animals.

The paper concluded by pointing out the necessity of making sera with isolated substances, and not with the crude products of bacteria. By injecting crude products it is more or less a matter of chance what the properties of the serum will be.

The proceedings ended at Johannesburg, as they had done at Cape Town, with an expression of thanks to the local officials of the section who had taken infinite pains to bring the meetings up to the high level of interest which they attained. J. BARCROFT.